REMARKS

Claims 1-10, 12, 13, 15-17 and 19-35, and 39-49 are currently pending in the subject application and are presently under consideration. Claims 1-6, 8-10, 13, 15-17, 19-33, 35, 39, 40, and 44-46 have been amended as shown on pages 2-12. Claims 47-49 have been cancelled. New claims 50-53 have been added. Claims 11, 14, 18, and 36-38 were cancelled previously.

Favorable reconsideration of the subject patent application is respectfully requested in view of the comments and amendments herein.

I. Terminal Disclaimer

Pursuant to the Examiner's request, a new terminal disclaimer in compliance with 37 C.F.R 1.321 has been filed herewith, signed by an attorney of record. This terminal disclaimer replaces the terminal disclaimer filed on August 11, 2009.

II. Claim Objections

Claim 3 is objected to because of an unclear amendment to the parent reference number in the response to the previous Office Action. That claim has been amended herein to correct the parent reference number.

Claim 5 has been amended to delete the redundant word "prognostics."

Claim 8 has been amended to delete the term "and/or components" to maintain consistency with independent claim 1.

Claim 10 has been amended to delete the word "environment" from the preamble in order to provide a more clear antecedent basis for the term "industrial automation system" as used later in the claim.

Claim 15 has been amended to replace "industrial automation system" with "at least one machine" in order to maintain consistency with independent claim 1.

Claim 33 has been amended to correct the word "from."

Reconsideration and withdrawal of these objections is respectfully requested in view of the above amendments.

III. Rejection of Claims 2, 3, 6, 7, 21, 22, 24-29, 44, and 45 Under 35 U.S.C §112

Claims 2, 3, 6, 7, 21, 22, 24-29, 44, and 45 stand rejected under 35 U.S.C §112, second paragraph, as being indefinite for allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claims have been amended herein to address the Examiner's concerns in this regard, as described in more detail below.

Claim 2 has been amended to delete the extraneous portion of that claim following the first period.

Claim 4 has been amended to update that claim's parent reference, thereby providing an antecedent basis for the "prognostic engine" recited in claim 6.

Claim 2 has been amended to include an antecedent basis for the recitation of "the inference" in claim 7.

Claim 40 has been amended to delete references to a "machine" for which there are no antecedent bases.

Claim 44 has been amended to delete references to an industrial automation system for which there are no antecedent bases.

Claim 21 has been amended to delete the word "performance," thus bringing the term "optimum efficiency point" into consistency with the claims depending from claim 21.

In view of these amendments, it is respectfully requested that this rejection be withdrawn.

IV. Rejection of Claims 1, 2, 4-6, 8-9, 39, 44, 45 and 47-49 Under 35 U.S.C. §103(a)

Claims 1, 2, 4-6, 8-9, 36, 39, 44,45 and 47-49 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Reid, *et al.* (U.S. Patent No. 6,298,308) in view of Hays *et al.* (U.S. Patent No. 6,330,525). It is respectfully submitted that this rejection should be withdrawn for at least the following reasons. Reid, *et al.* and Hays, *et al.*, individually or in combination, do not disclose or suggest all aspects set forth in the subject claims.

> To reject claims in an application under § 103, an examiner must establish a prima facie case of obviousness. A prima facie case of obviousness is established by a showing of three basic criteria. First, there must be some apparent reason to combine the known elements in the fashion claimed by the patent at issue (*e.g.*, in the references themselves, interrelated teachings of multiple patents, the effects of

> demands known to the design community or present in the marketplace, or in the knowledge generally available to one of ordinary skill in the art). To facilitate review, this analysis should be made explicit. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. See MPEP § 706.02(j). See also KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398, 04-1350, slip op. at 14 (2007). The reasonable expectation of success must be found in the prior art and not based on applicant's disclosure. See In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)

The present application relates generally to optimization of process performance according to one or more performance criteria. This can include optimization of a motorized system. A desired operating point can be selected within an allowable range of operation about a system setpoint according to performance characteristics associated with a plurality of components in the system (see, *e.g.*, page 8, line 31 through page 9 line 2). The system may be operated at an operating point within this range at which one or more performance characteristics are optimized. Thus, for example, where an allowable flow control range and setpoint provide for control between upper and lower acceptable flow rates, the present application can provide for selecting the operating point therebetween in order to optimize one or more system or component performance characteristics, such as life cycle cost, efficiency, life expectancy, safety, emissions, operational cost, MTBF, noise, and vibration(see, *e.g.*, page 9, lines 6-21). The selection of the operating point can include correlating component performance information associated with one or more components in the system in order to derive correlated system performance information, and selecting the operating point as the optimum performance point within the allowable range of operation according to the correlated system performance information (see, e.g., page 66, lines 5-10, and page 67, lines 3-14). In particular, amended independent claim 1 recites, *a correlation engine that analyzes the data and* ***correlates efficiency information for at least two of the plurality of machines to derive correlated system efficiency information****; and an optimization component that* ***employs the correlated system efficiency information to select an operating point within an allowable range of operation about a system setpoint*** *and controls the industrial business operations in part according to the operating point,* ***the operating point selected to optimize a total energy utilization of the plurality of machines based on the correlated system efficiency information.***

The Office Action concedes that Reid, *et al.* fails to disclose the functionality of the optimization component and correlation engine of claim 1, but argues that Hays, *et al.* remedies these deficiencies. Hays, *et al.* relates to a technique for diagnosing rotating equipment used in the factory and process control industry, and in particular diagnosis of centrifugal pumps. This diagnosis is based on a comparison of the current pump signature curves resulting from the acquisition of process variables from sensors monitoring the current condition of the pump and the original or previous pump performance curve from prior monitoring or knowledge of the pump geometry, installation effects, and properties of the pumped process liquid (see Abstract). With regard to selection of an operational setpoint, the Office Action notes in particular that diagnostic information generated by the above-described diagnostic technique can be communicated to a control system to facilitate adjustments to pump operation for operating closer to the pump's best efficiency point (BEP) (column 20, lines 56-58). However, this diagnostic information is not used to determine a control strategy that optimizes *energy utilization* in general, much less to optimize a total energy utilization for a plurality of machines comprising a business operation. Rather, as noted in the description above, Hays, generates diagnostic information is based exclusively on a comparison of current and previous process signature curves for the pump. Column 8, lines 41-48 of Hays, *et al.* define such a curve as a plot of "the relationships between the dependent *head or pressure* and the independent variable, *flow*" (emphasis added). These curves do not take energy utilization into consideration, nor does any subsequent adjustment to pump operation based on these curves seek to optimize this business objective. Rather, the cited reference indicates that this control adjustment serves to bring the pump closer to its manufacturer designated BEP for the purpose of increasing pump life. Hays, *et al.* is silent with regard to performing any manner of control adjustment, including selection of an operational setpoint, for optimization of energy utilization.

Moreover, neither of the cited references disclose or suggest correlating efficiency information from *at least two system devices* for the purpose of optimizing total energy utilization. In particular, Reid, *et al.* relates to the use of local experts to receive and analyze vibration data from a plurality of machines, and to diagnose a condition of the machines based on this vibration data (see Abstract). These local experts are provided at various machine sites, and act as automated data collector/analyzers configured to acquire and analyze vibration data substantially continuously from one or more machines located at the site (see column 2, lines 36-

41). These local experts can identify which bearings need to be replaced on a machine, the specific part numbers of the bearings, and may provide instructions for enabling a maintenance engineer to make any necessary parts (see columns 3, lines 20-25). However, Reid, *et al.* does not contemplate correlation of data associated with *two* different machines in the given site. Rather, Reid, *et al.* discloses only embodiments in which vibration data from any given machine is analyzed in isolation with respect to vibration data from other machines, for the purpose of detecting a potential failure associated with the given machine (see at least column 6, lines 41-46, column 12, lines 11-31, and elsewhere). Since Reid, *et al.* does not disclose correlation of data between two machine components in general, the cited reference therefore fails to disclose or suggest using such correlated system efficiency information to select an operational setpoint as discussed above.

Hays, *et al.* is also silent regarding such a correlation of efficiency data. As noted above, Hays, *et al.* diagnoses impending failures for a given piece of equipment (typically a pump) by comparing current and previous signature curves associated therewith. However, this diagnosis is only performed in the context of a *single* pump (or other piece of equipment), in that both signature curves being compared (current and previous) are associated only with the particular piece of equipment of interest. Hays, *et al.* does not disclose correlating efficiency information for *at least two devices* to derive correlated system efficiency information used to optimize a total energy utilization.

Similarly, amended independent claim 39 recites, ***correlating efficiency information for at least two devices*** *of a plurality of devices comprising an industrial control system to derive correlated system efficiency information; analyzing business concern data;* ***specifying a business objective, the business objective including at least one of revenue generation or total energy utilization for the industrial control system****; and* ***prescribing an operational setpoint for at least one of the plurality of devices that optimizes the specified business condition based on the correlated system efficiency information.*** As noted supra, neither Reid, *et al.* nor Hays, *et al.* disclose selection of a setpoint that optimizes total energy utilization, or doing so based on correlated efficiency information for at least two devices. The cited references also fail to disclose optimizing revenue generation using this method.

Likewise, amended independent claim 44 recites, *a component that receives data relating to a state of a subset of machines that are part of the industrial business operations and*

correlates efficiency information for at least two of the subset of machines to derive correlated system efficiency information*...and an optimization component that* ***selects an operating point*** *within an allowable range of operation about a system set point* ***based on the correlated system efficiency information*** *and controls at least one of the subset of machines according to the operating point,* ***the operating point selected to optimize a total energy utilization of the industrial business operations***. Neither Reid, *et al.* nor Hays, *et al.* disclose or suggest these features, as discussed *supra*.

Moreover, according to one or more embodiments, machines in a system can comprise prognostic components that can work with a prognostics engine in connection with diagnosing and prognosing the network (see, *e.g.*, page 18, lines 19-22). These prognostic components can provide for collecting or generating data relating to historical, current, and predicted operating states (see, *e.g.*, page 27, lines 3-6). These prognostic components can exchange and share data so as to schedule maintenance of a particular machine or load balance (see, *e.g.*, page 49, lines 6-7). In particular, amended claim 4 recites, *at least a subset of the plurality of machines comprising respective prognostic components that generate state information relating to at least one of historical, current, or predicted operating states of the respective machines,* ***the prognostic components share the state information with one another***.

Arguing that Reid, *et al.* discloses such prognostic components, the Office Action indicates in particular the local experts described in that reference and discussed above. However, it is nowhere stated in Reid, *et al.* that these local experts can *share state information with one another*. Rather, the cited local experts are configured to relay their associated machine information only to one of the remote monitoring devices depicted in Figure 2 of that reference (items 22, 24, 26, and 28 of that Figure; see column 8, lines 11-19 of Hays, *et al.*). Although Reid, *et al.* indicates that multiple local experts can share a system backbone, column 8, lines 11-19 of the cited reference indicates that this backbone only serves to provide communication between each local expert and one of the remote monitoring devices of Figure 2. Reid, *et al.* does not disclose that the local experts can *share state information with one another*. Indeed, in the context of the diagnostic system set forth in Reid, *et al.*, there would be no motivation for the local experts to share their information with one another, since each local expert is only concerned with reporting potential failures associated with its *own respective machine*, and is not concerned with collaborative optimization of a system comprising multiple machines. For at

least these reasons, it is respectfully submitted that the local experts described in Reid, *et al.* do not read on the prognostic components set forth in amended claim 4. Hays, *et al.* does not remedy these deficiencies, since the pump diagnostic system of that reference does not incorporate prognostic components that are associated with a given machine and that share state information with one another.

Also, in accordance with one or more embodiments of the present application, an intelligent agent scheme can be employed wherein various machines, physical entities, or software entities can be modeled and represented by intelligent software agents that serve as proxies for the respective machines or entities. These agents can be designed to interact with one another and facilitate converging on various modifications and control of the machines of entities in connection with efficiently optimizing an overall business concern. Lower level agents can collaborate and negotiate to achieve lower level process objective in an optimal manner and integrate this information to higher level agents (see, *e.g.*, page 7, lines 8-15). In particular, amended claim 8 recites, *at least a subset of the plurality of machines are respectively represented by intelligent agents that collaborate to determine at least one control modification of the plurality of machines that the total energy utilization for the plurality of machines.*

With regard to these intelligent agents, the Office Action again indicates the local agents described in Reid, *et al.* However, as already noted, these intelligent agents do not exchange information or collaborate with one another in any manner, and for at least this reason do not disclose or suggest the intelligent agents of amended claim 8. Moreover, as already discussed, neither Reid, *et al.* nor Hays, *et al.* disclose or suggest modifying control of one or more machines to optimize a total energy utilization. The cited references therefore fail more specifically to disclose the use of collaborative intelligent agents to perform such an optimization.

In addition, according to one or more embodiments, the present application can continually monitor energy costs (e.g., via the Internet) and dynamically change machinery operation based on new energy costs to maximize revenue generation (see, e.g., page 39, lines 25-30). In particular, new claim 53 recites, *monitoring current energy costs; and selecting the operating setpoint based at least in part on the current energy costs.* Neither Reid, et al. nor Hays, et al. contemplate selecting an operating setpoint based on *monitored current energy costs.*

In view of at least the foregoing, it is respectfully submitted that Hays, *et al.* and Reid, *et al.*, individually or in combination, do not disclose or suggest all aspects of amended independent claims 1, 39, and 44 (and all claims depending there from), and as such fail to render obvious the present application. It is therefore requested that this rejection be withdrawn.

V. Rejection of Claims 3 and 7 Under 35 U.S.C. §103(a)

Claims 3 and 7 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Reid, *et al.* in view of Hays, *et al.* and further in view of Roemer, *et al.* ("Advanced Diagnostics and Prognostics for Gas turbine Engine Risk Assessment", IEEE 2000). However, claims 3 and 7 depend from amended independent claim 1, and as discussed in the previous section of the Reply in connection with that independent claim, Reid, *et al.* and Hays, *et al.* fail to disclose or suggest *correlation of efficiency information for at least two of a plurality of machines to derive correlated system efficiency information,* and *employing the correlated system efficiency information to select an operating point within an allowable range of operation that optimizes a total energy utilization of the plurality of machines*. Roemer, *et al.* does not cure these deficiencies. Roemer, *et al.* describes diagnostic and prognostic techniques for integrated health monitoring of gas turbine engines (see Abstract). According to these techniques, validated sensor information measured on the engine is fed directly into diagnostic algorithms for fault detection and classification. The validated sensor data and real-time diagnostic information is utilized by prognostic modules to predict future time-to-failure, failure rates, or degraded engine condition (see page 346, column 1, lines 1-15). However, since Roemer, *et al.* only describes embodiments in which sensor information is collected and analyzed for a *single* engine, the cited reference does not contemplate correlation of efficiency information for multiple devices. It also follows that Roemer, *et al.* does not disclose utilizing such correlated efficiency information to set an operating point that optimizes a total energy utilization of a plurality of machines.

In view of at least the foregoing, it is respectfully requested that this rejection be withdrawn with respect to claims 3 and 7.

VI. Rejection of Claim 46 Under 35 U.S.C. §103(a)

Claim 46 is rejected under 35 U.S.C. 103(a) as being obvious over Reid, *et al.* in view of Hays, *et al.* and in view of Burris, *et al.* (U.S. Publication 200310208394). However, claim 46 depends from amended independent claim 44, and as discussed *supra* in connection with that independent claim, Reid, *et al.* and Hays, *et al.* are silent with regard to *correlating efficiency information for at least two machines to derive correlated system efficiency information*, and *selecting an operating point within an allowable range of operation about a system set point based on the correlated system efficiency information that optimizes a total energy utilization of an industrial business operations.* Burris, *et al.*, which relates to a method for tracking and forecasting product sales, does not make up these shortcomings. It is therefore respectfully requested that this rejection be withdrawn.

VII. Rejection of Claims 10, 13, 15-17, 19-22, 24-29, and 32-35 Under 35 U.S.C. §103(a)

Claims 10, 13, 15-17, 19-22, 24-29, and 32-35 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Reid, *et al.* in view of Hays, *et al.*, and further in view of Soneda, *et al.* (US Patent No. 6,619,111). It is respectfully submitted that this rejection should be withdrawn for at least the following reasons. Reid, *et al.*, Hays, *et al.*, and Soneda, *et al.*, individually or in combination, do not disclose or suggest all features set forth in the subject claims.

Amended independent claim 10 recites, ***correlating efficiency information for at least two of the subset of machines*** *to derive correlated system efficiency information; [and] selecting an operating point within an allowable range of operation about a system setpoint, the* ***operating point selected to optimize a total cost of energy utilization of the subset of machines according to the correlated system efficiency information***. As discussed above in connection with amended independent claim 1, Reid, *et al.* and Hays, *et al.* fail to disclose or suggest these aspects. Soneda, *et al.* does not remedy these deficiencies. Soneda, *et al.* relates to a method for monitoring the performance of internal pumps in an internal pump plant, such that variation of the pump performance is detected at an early stage (see column 2, lines 16-21). According to this method, the power input to the pump motor that drives the internal pumps is measured, and the input power to the pump motor is estimated based on a test performed outside the plant corresponding to the pump speed and the flow of the pump measured at the plant. A ratio of the

actual measured value of the power input to the pump motor to the estimated value is computer, and performance variation of the internal pump is detected (see column 2, lines 22-32). However, no operating points are selected as a result of these detected performance variations. Rather, Soneda, *et al.* only states the computed ratio described above is transmitted to a pump performance ratio display screen for periodic display (see at least column 8, lines 4-8). No control-related changes are performed using this data, much less selection of an operating point that optimizes a total energy utilization of a subset of machines. Soneda, *et al.* therefore fails to make up the shortcomings of Reid, *et al.* and Hays, *et al.* in this regard.

Similarly, amended independent claim 33 recites, *means for* ***correlating efficiency information for at least two of the plurality of machines*** *or in order to derive correlated system efficiency information; [and] means for* ***selecting an operating point*** *within an allowable range of operation about a system setpoint according to the correlated system efficiency information,* ***the operating point selected to optimize a total energy utilization of the industrial automation system***. None of the cited references disclose or suggest these features.

Also, amended claim 29 recites, *correlating the component performance information comprises correlating efficiency information related to at least two of a motor, a pump, or a motor drive to derive cost information related to the industrial automation system operational cost per unit of fluid pumped through the pump*. None of Reid, *et al.*, Hays, *et al.*, or Soneda, *et al.* disclose methods for deriving such cost information. The cited references therefore fail more particularly to disclose deriving this cost information based on a correlation of efficiency information related to at least two of a motor, a pump, or a motor drive.

In view of at least the foregoing, it is respectfully submitted that Reid, *et al.*, Hays, *et al.*, and Soneda, *et al.*, individually or in combination, do not disclose or suggest all features of amended independent claims 10 and 33 (and all claims depending there from), and as such fail to make obvious the present application. It is therefore requested that this rejection be withdrawn.

VIII. Rejection of Claims 12 and 23 Under 35 U.S.C. §103(a)

Claims 12 and 23 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Reid, *et al.* in view of Soneda, *et al.*, and further in view of Hays, *et al.* and Eryurek, *et al.* (US Patent No. 6,795,798). However, Eryurek, *et al.*, which relates to a system that collects process data within a process control plant and transmits the process data to a remote data

processing facility for analysis, does not cure the aforementioned shortcomings of the other cited references with regard to *correlating efficiency information for at least two machines to derive correlated system efficiency information*, and *selecting an operating point within an allowable range of operation to optimize a total energy utilization according to the correlated system efficiency information*, as provided in amended independent claims 1 and 10. It is therefore respectfully requested that this rejection be withdrawn with respect to claims 12 and 23, which depend from amended independent claims 1 and 10, respectively.

IX. Rejection of Claims 30 and 31 Under 35 U.S.C. §103(a)

Claims 30 and 31 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Reid, *et al.* in view of Soneda, *et al.* and Hays, *et al.*, and further in view of Admitted Prior Art (hereinafter APA). It is respectfully requested that this rejection be withdrawn for at least the following reasons. Reid, *et al.*, Soneda, *et al.*, Hays, *et al.*, and APA, individually or in combination, do not disclose or suggest all aspects of the subject claims.

In addition to the features already discussed, one or more embodiments of the present application can predict a component failure using the correlated data described above, establish when a replacement component can be delivered and installed, and automatically alter control to ensure continued operation until the replacement part arrives. Alterations in the control can automatically be made based on changes in an expected delivery data and prognostic algorithms results. Delays in receiving the needed replacement can cause the part to be ordered from another source and the control dynamically altered as needed (see, *e.g.*, page 49, line 23 through page 50, line 8). In particular, amended independent claim 30 recites, *selecting, in response to predicting the failure, a new operating point calculated to maintain continued operation of the identified component until at least an anticipated arrival time of the replacement component; and controlling at least one machine according to the new operating point.*

As noted above, Reid, *et al.* does not contemplate selecting an operational setpoint for any purpose, but instead only outputs notification information based on component problems detected by local experts. It therefore follows that Reid, *et al.* does not disclose selection of a *new operating point* in response to a predicted failure *calculated to maintain continued operation of an identified component until an anticipated arrival time of a replacement component.*

Hays, *et al.*, Soneda, *et al.*, and APA also fail to consider an anticipated arrival time of a replacement component in any context, and therefore do not make up the shortcomings of Reid, *et al.* in this regard.

Also, claims 30 and 31 depend from amended independent claim 10, and as already discussed, the cited references fail to disclose or suggest *correlating efficiency information for at least two machines to derive correlated system efficiency information*, and *selecting an operating point within an allowable range of operation to optimize a total energy utilization according to the correlated system efficiency information*, as provided in that independent claim as amended. APA does not cure these deficiencies.

In view of at least the foregoing, it is respectfully requested that this rejection be withdrawn.

X. Rejection of Claim 40-43 Under 35 U.S.C. §103(a)

Claims 40-43 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Eryurek, *et al.* in view of Soneda, *et al.* However, amended independent claim 40 recites, ***correlating component performance information for at least two devices operating within the industrial automation system****; deriving correlated process performance information based on the correlating; inferring a failure period for at least one device operating within the industrial automation system based on the correlated process performance information; automatically ordering a replacement component for the at least one device prior to an inferred failure period;* ***selecting, in response to the inferring, an operating point calculated to maintain continued operation of the at least one device until at least an anticipated arrival time of the replacement component****; and controlling at least one machine in the industrial automation system according to the operating point*. As discussed in the previous section of the Reply, Soneda, *et al.*, Reid, *et al.*, and Hayes, *et al.* fail to disclose selecting an operating point based on an anticipated arrival time of a replacement component. The remote process analysis system of Eryurek, *et al.* also fails to disclose these features. Although the Office Action indicates that Eryurek, *et al.* can generate work orders and order parts based on detected problems with the plant, it is noted that the cited reference does not indicate that an operating point for controlling a machine can be selected in accordance with an anticipated arrival time of a replacement component. Eryurek, *et al.* therefore does not cure the shortcomings of the other cited references in this regard.

In view of at least the foregoing, withdrawal of this rejection is respectfully requested.

CONCLUSION

The present application is believed to be in condition for allowance in view of the above comments and amendments. A prompt action to such end is earnestly solicited.

In the event any fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063 [ALBRP246USC].

Should the Examiner believe a telephone interview would be helpful to expedite favorable prosecution, the Examiner is invited to contact applicants' undersigned representative at the telephone number below.

Respectfully submitted,

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